

CLAIMS

What is claimed:

1. A method for an invasive procedure on a breast of a patient comprising:
 - a) positioning a breast of a patient between at least two non-magnetically susceptible supports;
 - b) applying pressure to said breast with said at least two supports;
 - c) examining said breast with MRI; and
 - d) inserting and guiding a medical implement into said breast with constant MRI visualization of the inserting and guiding.
2. The method of claim 1 wherein while examining said breast with MRI, at least one of said at least two supports is repositioned.
3. The method of claim 1 wherein while examining said breast with MRI, at least one of said at least two supports is repositioned by mechanical means.
4. The method of claim 1 wherein while examining said breast with MRI, at least one of said at least two supports is repositioned by mechanical means that are operator remote controlled.
5. The method of claim 1 wherein while examining said breast with MRI, at least one of said at least two supports is repositioned by mechanical means to alter the relative position of tissue within said breast.
6. The method of claim 1 wherein said at least two supports are positioned so that a path between said at least two supports allows a linear path into said breast that is not perpendicular to a line parallel with a spine of the patient.
7. The method of claim 1 wherein after positioning the breast of a patient, at least one support is rotated relative to the breasts around an axis, then a universal probe

stage is positioned onto a surface of a support, then the probe stage is rotated to an angle relative to the support, and then the depth of a probe is set.

8. The method of claim 1 wherein said medical implement has MR visible markers thereon.

9. The method of claim 1 wherein said medical implement comprises RF coils on a substrate.

10. The method of claim 1 wherein said medical implement comprises a catheter.

11. The method of claim 1 wherein a computer stores a program and said program calculates step-motor instructions and controls at least one motion drivers controlling motion of said implement.

12. The method of claim 1 wherein a computer stores a program and said program forwards data indicating a visualization of position of said implement within said breast in real time.

13. The method of claim 2 wherein said at least two supports are fastened together to resist relative movement between said at least two supports and said repositioning is effected by temporarily unfastening or loosening the at least two supports, repositioning at least one of the supports, and then refastening said at least two supports.

14. A method for an invasive procedure on a breast of a patient comprising:
 positioning a breast of a patient between at least two non-magnetically susceptible supports;
 injecting the patient with a contrast agent so that the concentration of the contrast agent within the breast will increase to a maximum concentration for a period of time after injection;

before, during or slightly after the concentration of the contrast agent reaches the maximum concentration, applying pressure to the breast to restrict blood flow within the breast;

maintaining the pressure on the breast to reduce the rate of flow of contrast agent out of the breast; and

examining tissue by a non-invasive procedure of the breast which examining procedure is enhanced by the use of said contrast agent while the rate of blood flow is restricted.

15. The method of claim 14 wherein an invasive procedure on the breast is performed under examination by the non-invasive procedure.

16. The method of claim 15 wherein, after the maximum concentration of contrast agent has occurred and after concentration of the contrast agent has decreased, releasing pressure on said breast, reinjecting the patient with contrast agent, allowing the concentration of contrast agent to increase to a concentration less than the maximum concentration that will occur from the injection, and before the maximum concentration has occurred, applying pressure to the breast to restrict the flow of blood within the breast.

17. The method of claim 15 wherein a device for performing the invasive procedure is supported on a moveable support near one of the at least two non-magnetically susceptible supports, and said device is moved relative to said one of the at least two non-magnetically susceptible supports to position the device for performing invasive surgery on the breast.

18. The method of claim 18 wherein the device is moveable in three dimensions for position the device relative to the at least two non-magnetically susceptible supports.

19. The method of claim 14 wherein at least one of said supports has a window or holes therein and an invasive medical device is inserted through a hole or said window and into the breast.
20. The method of claim 19 wherein said invasive medical device is inserted through said window or hole and into said breast during real-time examining under said non-invasive procedure.
21. The method of claim 14 wherein said non-invasive procedure comprises magnetic resonance imaging.
22. The method of claim 15 wherein said non-invasive procedure comprises magnetic resonance imaging.
23. The method of claim 16 wherein said non-invasive procedure comprises magnetic resonance imaging.
24. The method of claim 17 wherein said non-invasive procedure comprises magnetic resonance imaging.
25. The method of claim 19 wherein said non-invasive procedure comprises magnetic resonance imaging.
26. The method of claim 2 wherein in addition to repositioning the two supports, a probe stage is also rotated.
27. A system comprising:
a first compression surface;
a second compression surface aligned substantially parallel with the first compression surface wherein the first compression surface and the second compression surface are each positioned along a first axis;

a compression adjuster adapted to adjust a distance between the first compression surface and the second compression surface along the first axis;

a stage coupled to the first compression surface and the second compression surface and adapted to rotate on a second axis substantially orthogonal to the first axis; and

a probe guide having an intervention axis and adapted to guide a probe for insertion into a region between the first compression surface and the second compression surface along the intervention axis.

28. The system of claim 27 further comprising a height adjuster coupled to the stage and adapted to adjust a height between the stage and a supporting surface.

29. The system of claim 28 further including a stage height remote control coupled to the height adjuster.

30. The system of claim 27 further comprising a lateral adjuster coupled to the stage and adapted to adjust a lateral distance between the stage and a supporting surface.

31. The system of claim 30 further including a stage lateral position remote control coupled to the lateral adjuster.

32. The system of claim 27 further comprising a probe guide angle adjuster coupled to the stage and the probe guide and adapted to adjust an angle between the probe guide and the stage.

33. The system of claim 32 further including a probe guide angle remote control coupled to the probe guide angle adjuster.

34. The system of claim 27 further comprising a probe guide height adjuster coupled to the stage and the probe guide and adapted to adjust a height of the probe guide relative to the stage.
35. The system of claim 34 further including a probe guide height remote control coupled to the probe guide height adjuster.
36. The system of claim 27 further comprising a probe guide depth stop adjuster coupled to the probe guide and adapted to adjust an insertion distance of a probe coupled to the probe guide.
37. The system of claim 36 further including a depth stop remote control coupled to the probe guide depth stop adjuster.
38. The system of claim 27 further comprising a patient supporting surface adapted to rotate on a supporting surface axis aligned orthogonal to the second axis and substantially parallel with a spine of a patient when a patient is positioned on the supporting surface.
39. The system of claim 38 further including a patient support remote control coupled to the patient supporting surface.
40. The system of claim 27 further including one or more linear actuators coupled to the compression adjuster.
41. The system of claim 40 further including one or more remote controls coupled to the one or more linear actuators.
42. The system of claim 27 further including a rotational actuator coupled to the stage.

43. The system of claim 42 further including a stage remote control coupled to the rotational actuator.
44. The system of claim 27 wherein the first compression surface includes a window.
45. The system of claim 44 wherein the window includes a permeable cover.
46. The system of claim 44 wherein the window includes a sterilizeable permeable cover.
47. The system of claim 44 wherein the window includes a permeable mylar cover.
48. The system of claim 27 wherein the probe guide is coupled to the rotational stage.
49. The system of claim 27 fabricated of magnetic resonance imaging (MRI) compatible material.
50. The system of claim 49 wherein the MRI compatible material includes plastic.
51. A system comprising:
a rotatable platform having a first rotational axis;
a first rigid structure substantially normal with, and coupled to, the platform;
a second rigid structure substantially normal with, and coupled to, the platform;
a compression adjuster coupled to the platform and adapted to adjust a distance between the first rigid structure and the second rigid structure;

a guide, having a guide axis, coupled to the platform and aligned to direct a probe along the guide axis into a region disposed between the first rigid structure and the second rigid structure;

a first remote control coupled to the guide and adapted to adjust an angle between the guide axis and the platform; and

a second remote control coupled to the guide and adapted to adjust a distance between the guide axis and the platform.

52. The system of claim 51 further comprising a third remote control coupled to the guide and adapted to adjust a depth of insertion of a probe coupled to the guide.

53. The system of claim 51 further comprising a fourth remote control coupled to the platform and adapted for adjusting a vertical position of the platform relative to a patient support surface.

54. The system of claim 51 further comprising a fifth remote control coupled to the platform and adapted for adjusting a horizontal position of the platform relative to a patient support surface.

55. The system of claim 51 wherein the first rigid structure includes a passage to admit a probe coupled to the guide.

56. The system of claim 51 wherein the first rigid structure is adjustably coupled to the platform and the second rigid structure is immovably coupled to the platform.